AMERICAN
MECHANICS' MAGAZINE,
Museum, Register, Journal and Gazette.

Come, bright Improvement! on the car of Time,
And rule the spacious world from clime to clime;
Thy handmaid Arts shall every wild explore,
Trace every wave, and culture every shore.——*Campbell.*

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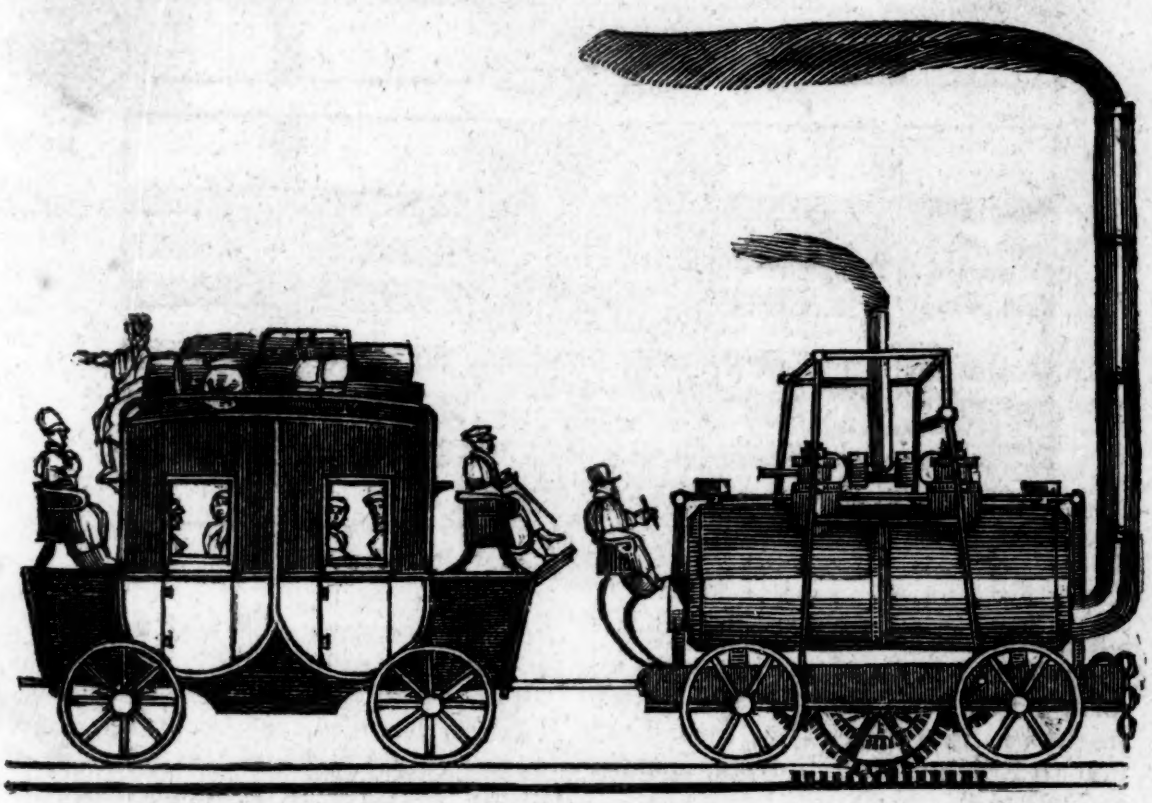
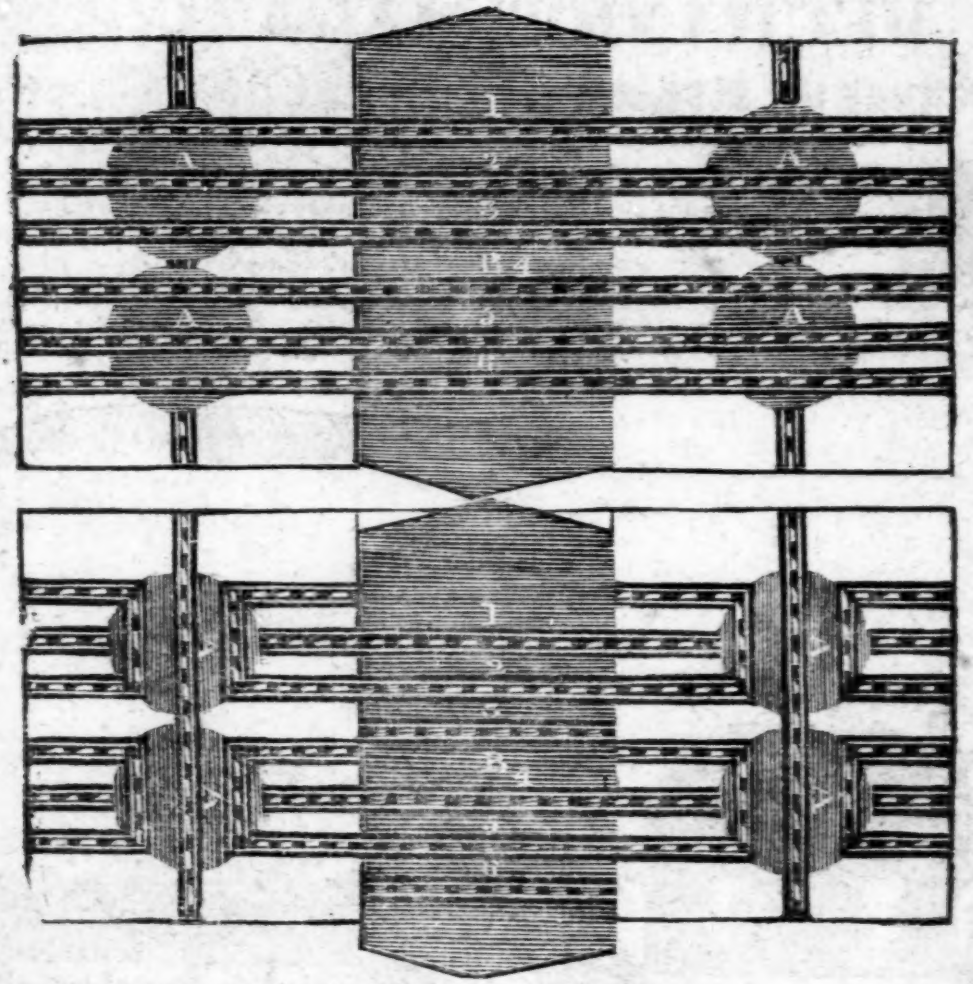


PROPOSITION FOR A GENERAL IRON RAIL-WAY, WITH STEAM-ENGINES, TO SUPERSEDE THE NECESSITY OF HORSES IN ALL PUBLIC VEHICLES.

Soon shall thy arm, unconquer'd Steam afar
Drag the slow barge, or drive the rapid car;
Or on wide-waving wings expanded bear
The flying chariot through the fields of air.
DARWIN.

It has been remarked, that rail-ways have hitherto been confined almost exclusively to coal works and other mines, and that inventions whose only recommendations are *simplicity* and *usefulness* are often suffered to lie long in a state of public neglect, whilst others of less real utility, being pertinaciously blazoned forth by interested or blinded partisans, are readily adopted, and bask for a while in the sunshine of public favour.
REES' ENCYCLOPÆDIA.

THE intention of the present scheme is to introduce a more economical and expeditious mode of conveyance than is now in use, for vehicles of every kind, whether employed in the transport of persons or merchandize. It is proposed to supersede entirely the necessity of horse power in all public wagons, stage and mail coaches, post chaises, &c. and to employ in its stead the more potent agency of steam. A careful examination of the drawings now presented to the public, as a plan of a general iron rail-way, will, it is hoped, clearly demonstrate the ease, safety, and celerity with which vehicles of every denomination, for the conveyance of goods and persons, may be propelled by mechanic power. The



six parallel railways which extend the whole length of our inner plate, form a general iron railway, which might run in a direct line from London to Edinburgh, and from London to Falmouth.

The branches from the direct line require that there should be one or two railways for carriages going, and an equal number for those returning.

The four circular plates A, are to afford a ready and immediate communication by turning the vehicle off (see lower section of the plate) into their respective branch railways. The sliding frame B, shows in what manner vehicles may be removed into any of the six parallel tracks or railways, in case a carriage of superior speed be obstructed by any other of inferior speed; also in case of accidents, or of any necessary repairs.

The circular plates are to be let into the general iron railway, wherever the communication with a branch railway may require it.

The sliding frame should be laid at regular distances, as the public convenience may demand; also for particular or local accommodation, as experience shall best instruct.

The rollers, or machinery on which the circulars, plates, and sliding-frames are to act, must be of sufficient strength and power to carry any weight whatever.

The operation of these machines may be effected by horse or steam power, as circumstances may determine.

The rack or cog-rail, in each railway, is where the cog-wheel of the steam engine employs its force to impel the caravans, wagons, and coaches. Being placed in the middle of the track, it gives the most uniform power to the permanent action of the steam engine, and would also exclude the use of horses, and thereby preserve the rail roads from destruction

and continual dilapidation, the attendant consequences of employing horses.

Steam carriages, on the plan now proposed, would answer every purpose required by the intercourse of the country, and clearly prove, that the vast expenses now caused by the employment of horses is totally unnecessary.

It will scarcely be credited, that a stock of 100,000 horses renewed every four years, will cost for their keep and interest of capital in the course of twelve years, no less than thirty-four millions seven hundred thousand pounds. The great saving which might be effected by the employment of steam power, will be obvious to every one, when it is mentioned, that instead of each coach changing horses between London and Edinburgh, say twenty-five times, requiring one hundred horses, besides the supernumerary ones kept at every stage in case of accidents, the whole journey of *several* coaches would be performed in much less time, and with greater personal accommodation to the passengers, by the simple expense of one steam engine.

As a permanently improving source of revenue to government, this plan would have no parallel. The diurnal returns, at the most moderate rate, or tax upon each vehicle, would annually produce many millions; indeed no limits can be assigned to the increase of wealth which this change in our inland conveyance might produce. There is no branch of agriculture, no branch of commerce, or of arts, but would partake of its endless prosperity.

T. G.

CANAL BOATS.

No. I.

GENTLEMEN:—

With the single view to public improvement, I propose to submit to you, in a few short Numbers, some remarks on *the proper form of boats for navigating the canals of this state.*

In the first place, I lay it down as a truth, derived from experience, theory, and reason, that the form of a boat for navigating shoal and narrow bodies of water must necessarily be very different from that best adapted to the navigation of deep and ample expanses of water. In a canal, it is of the highest importance, to pass with the least possible agitation of the waters, because this injures the banks less, and the less the waters are agitated by the passing boat, the more easily it moves, with any given velocity.

This proposition is undeniable; in a canal where we have always smooth water, we have only to seek the best form of boats for passing easily; whereas, on large rivers, we must consult the means of security from waters made rough by winds and waves.

These circumstances being duly considered, as premises, we come next to consider the best possible form of a boat for canal navigation. Were we not circumscribed in the length of a boat, by that of the locks, the desideratum, in this case, would be perfectly plain, viz. to build sharp, fore and aft, giving a long cut-water taper, and making the stern shape the same as that of the bow. This is common practice, and I believe conformable to philosophical principles.

Let us consider that when the bow parts the water, its opening columns, on each side, pile against and under the sloping sides of the vessel, and thus exerts a force to raise the bow above the level of the stern, which makes the course of the vessel uniformly up a plain, more or less inclined, according to the velocity of the vessel.

To make this appear, it is only necessary to observe the effect produced by towing a small boat at the rate of 6, 8, 10, or 12 miles an hour, at the stern of a vessel. The principle is the same in all degrees of velocity, but is more clearly exhibited in the extremes.

In applying these remarks to the construction of canal boats, let it be remembered that this swell at the bow and the dead water astern, both retard the motion of the boat, and cause

that agitation which is so injurious to the banks of a canal; therefore, the true desideratum is a form of boat that, with any given velocity, shall pass with the least possible swell at the bow, or dead water astern, and the least possible agitation of the water, abreast and in the wake.

These, with the advantage of the greatest capacity of burthen, will be considered in another number.

As my object is a public one, discussion is desirable. If I advance any thing which is not perfectly sound, do me the justice to believe that I shall be glad to see it exposed in your columns. This subject is one of great importane, as is known to all who have witnessed the injury done to our canals by packets, and will be obvious to those who have not witnessed it, on considering, that the increased rates of toll on them is produced by this injury.

I assert, and think I shall be able to demonstrate, that canal packets may be so constructed, as to run much faster than any now on these canals, and do much less injury to their banks. They are very badly formed, and have richly merited the doom fixed upon them by the Canal Commissioners, in their late tariff of Tolls.

S.

MAGNESIAN EARTH FOR MANURE.

Sir,—The serpentine formation, which extends through parts of Pennsylvania and Maryland, is, from its unproductiveness, denominated by the neighbouring farmers "*the barrens.*" The incumbent soil, though generally shallow, is, at least so far as my observation extends, mellow, and frequently of a deep blackish colour, indicative of producing results quite opposite to what in reality is the fact.

This circumstance, connected with the sub-formation, induces the belief that the soil is surcharged with the constituents necessary to produce a healthy and vigorous vegetation; for the serpentine is in part composed of magnesia, which, according to the experiments of Arthur Young, is in small quantity, an excellent vegetable tonic or stimulant; but when applied too freely, produces quite a contrary effect.

I cannot now refer to the particular experiments made by Mr. Young; but judging from the effects produced on soils by alkaline earths, there is good ground for crediting his statement. Should what I suggest be fact, the soil of the serpentine formation, or of "*the barrens,*" will be found an excellent manure or stimulant for other soils. I have been led to publish these remarks, with a hope to induce some of our experimental farmers who reside in the vicinity to give this soil a full and fair trial. The subject of rendering this extensive district productive, or subservient to the productiveness of the neighbouring lands, is of great importance, and whoever shall demonstrate the practicability of such a measure, will deserve as much from his country as he who reclaims an equal extent of country from the dominion of the ocean.

H.

Baltimore, April 12th, 1825

VALANCE'S CROSS-CUTTING SAW.

Sir,—In answer to our friend Nauticus, who seems not to comprehend how my Cross-cutting Saw is to be used horizontally wrought by a pendulum twelve feet long, I have to inform him, that the length of the pendulum is no hindrance to cut trees close by the ground. The shaft which communicates the motion from the pendulum to the saw, can be placed either higher or lower, so as to give the proper motion to the saw; and a tree may be thus cut nearer the ground than it can be done with the common cross cut saw.

It is not intended that the frame should prevent the saw from cutting the tree, until it comes to the rod that the saw slides on, when the frame is fixed to the other side of the tree, and the saw wrought till it meets the first cut.

Iam, Sir,

Your obedient servant,

Dixon Vallance, Mechanic.

From the London Chemist.

PRINCIPLES OF COFFEE ROASTING.

(Mr. Evans's New Method.)

In the thirteenth Number of our Work, page 196, we gave a short account of the mode in which coffee is cultivated; and having lately met with a description of a new method of roasting it, for which a patent has been taken out by a Mr. Evans, we shall now give a description of this, and of the constituent parts of coffee.—From the experiments of Cadet and Hermann, it appears that the following substances may be obtained from this berry. The former of these gentlemen found that 64 parts yielded,

Gum	8. 0
Resin	1. 0
Extract and bitter principle	1. 0
Gallic acid	3. 5
Albumen	0.14
Fibrous insoluble matter	43.5
Loss	6.86
	64.0

We are indebted to Mr. Chenevix for the discovery in coffee of a bitter principle, to which the name of *caffein* has been given, which is soluble in water and alcohol, the solution having a pleasant bitter taste.

Dr. Thomson states, also, that when coffee is roasted, a portion of *tannin* is formed in it by the action of the heat; and that a new substance, having a peculiar, agreeable smell, is developed, but its nature has *not yet been ascertained*. It is developed also by *roasting* barley, beans, and a great variety of other vegetables, which are occasionally substituted for coffee. All coffee drinkers know perfectly well, that the flavour of their beverage depends in a great measure on the manner in which the berries are roasted; but we cannot say that any scientific experiments have hitherto been made to determine precisely the changes which coffee undergoes during this process. There can be no doubt, however, from the different smells which arise as the change is going on, that it is chemical.

In the description of the method of manufacturing pyrolignous acid, which appeared in No. XVII of the Chemist, we pointed out the fact of the elementary principles of vegetable substances, when subjected to different degrees of heat, entering into other combinations, and forming compounds not before met with in the vegetable.

Now, the substances we have mentioned above were detected in raw coffee; and it does not appear that those which are formed by the roasting have been so accurately examined M. Payssé, indeed, found that distilled coffee yielded an *acidulous water*, a *thick brown oil*, and *carbonate of ammonia*.*

We are, in fact, yet in the dark as to the changes which coffee undergoes in the roasting, and only know, from very imperfect practical results, what is apparently the best method of roasting it. Count Rumford, indeed, instituted some experiments on the subject, but, without ascertaining the changes produced by the operation, came to a practical conclusion, that only a small quantity of coffee should be roasted at once; that the heat should not be great; and that the process should be conducted in a thin glass retort. The one used by the Count had a long neck, and was closed with a cork, *having a small aperture at the side*, and projecting so far that it might be used as a handle in turning the retort round while exposed to the action of the heat. But though this is, probably, a very good plan for the amateurs of coffee, or for those who choose to be at the trouble of roasting it themselves every second or third day, it will never answer for the manufacturer or coffee-roaster.

The Count recommended, that not above half a pound should be roasted at a time, which would require one person in every third family to roast coffee every day, causing a prodigious waste of time and trouble. Under these circumstances, it is, therefore, to be wished, that the changes which coffee undergoes in burning should be more correctly ascertained, and the best mode of burning it on a large scale adopted.

The account of Mr. Evans's experiments, and the machine they led him to invent, seem to correspond with both these objects. It is sometimes the practice in England, under the notion of saving as much as possible, to burn the coffee in close vessels; but it results from the experiments above mentioned, as well as those of Mr. Evans, who, by the by, appears never to have heard either of Count Rumford or M. Payssé, that the first product of the roasting is an acidulous water. It is indispensable to get rid of this. Coffee roasted in close vessels is found, by retaining it, to become very soon soft, and

* Thomson's Chemistry, Vol. iv. p. 270.

to lose, by a farther decomposition occasioned by this acid, a considerable portion of its flavour, so as ultimately to become tasteless.

By an ingenious contrivance, which corresponds in principle perfectly, though on a large scale, with Count Rumford's *long cork* with a slit on one side, and adapted to rotatory roasters, which can be made of any size and of different forms, and to which heat can be applied in any required degree, Mr. Evans roasts his coffee so as to permit freely the escape of this acidulous water. The mechanical means by which this is accomplished, are as follow:—The axis of the roaster is hollow, and does not pass through it, but is divided into two portions, each of which is fixed to the end of the roaster by flanges. Into the hollow of the axis a tube is introduced, perforated towards the interior part with a number of small holes at the sides, while it is closed at the end, which serves as a chimney to carry off the acid liquor and vapour. Soon after the machine is placed over the fire, a dense steam, consisting of this acid substance and water, escapes.

But coffee also contains a *thick brown oil*, and the bitter principle, which are soluble in water, and very fragrant, and to which the fibrous and insoluble matter of the coffee owes its agreeable taste and refreshing powers. So volatile is this oil, that we are told "the aromatic substance extracted from coffee by boiling water is so feebly united with it, that it escapes into the air with great facility. If a cup of the very best coffee, prepared in the highest perfection, and boiling hot, be placed on a table in the middle of a room, and suffered to cool, it will, in cooling, fill the room with its fragrance; but the coffee, after having become cold, will be found to have lost a great deal of its flavour. If it be again heated, its taste and flavour will be still farther impaired; and after it has been heated or cooled two or three times, it will be found quite vapid and disgusting."*

After getting rid, therefore, of the acid, it is of essential importance that as much as possible of this fragrant and peculiar principle of the coffee should be preserved. There is even reason to believe that it may be much increased by, if it be not altogether the product of, the operation of roasting; as the vinegar from distilling wood, and the sugar from malting grain are the result of the changes these substances undergo during the distilling or malting process; certainly, however, it is possible wholly to destroy this fragrance, and to roast the coffee so that none of the oil remains, or that none is formed. We know that unless carbonic acid escapes from grain while malting, it is not converted into sugar; and in the same manner it would appear that unless the acid is driven off from the coffee, this fragrant oil is not formed.

It is, therefore, necessary to expel the acid, and produce or preserve as much of the oil as possible. In general, the only means adopted to accomplish this is, not to apply too much heat. Count Rumford was so cautious, that he used a glass vessel, in which he could see the process, and which, on being heated beyond what was necessary, melted.

Mr. Evans accomplishes this object in a manner superior, we think, to that of the Count. As it is not possible to employ glass for conducting the process on a large scale, he has adapted to his roaster what he calls an examiner, which is introduced through one end of the axis, and is so contrived, that he can take out a portion of coffee at any period of the process, without stopping the rotatory motion of the roaster.

When it is found, from the appearance of the berries from momentarily condensing the steam by a piece of slate held before the chimney, and other circumstances known to practical men, that the acid and water have escaped, and that the oil begins to pass off, by inserting another tube into the perforated tube serving as a chimney, Mr. Evans gradually closes the roaster, and completely prevents the escape of the volatile fragrant oil. In this point the method is superior to Count Rumford's, as he could only lessen the heat or remove the coffee to preserve the oil. By nearly closing up the vessel, however, it is found that the remainder of the process, so as to bring the coffee to a good colour, is more speedily performed, that a less quantity of fuel is necessary, and that a much greater proportion of the fragrant principle of the coffee is retained or created than if the whole process were conducted in an open vessel. By the ordinary methods of roasting, the loss is eight per cent.; by this new method, the loss is only four, and at the same time the acid is entirely driven off.

By an ingenious application of a swivel or ring, the instant the coffee is found to have been long enough exposed to the fire, the machine is swung away from it, and is continued in motion till the coffee is cooled, while another roaster can be placed over the fire. In consequence of preserving this oily matter in the coffee,

* Edinburgh Encyclopedia, Article, Coffee.

it has a glossy shining appearance, as if butter had been put into the roaster; but it never becomes rancid, as coffee so roasted does; and is not likely to become tough and tasteless, like coffee which still retains the acid, from being roasted in close vessels, or by the ordinary method. The appearance of the berries has sometimes led to the supposition, that the coffee was roasted with some substance, or soaked in some liquid; but while the acknowledged existence of an oil in coffee explains this, we know of no substance which would at all answer the purpose attributed to it by this supposition.

A great part of the art of roasting coffee consists in applying the heat gradually and equally to every part of all the berries. In the new method, this is effected by ledges placed diagonally in the roaster, which, as it revolves, turn over every berry. We consider Mr. Evans's coffee-roasting machine to be constructed on correct principles; and have no doubt that coffee thus burnt will be much superior to that burnt by the ordinary method. It is an improved application, on a large scale, of the principles pointed out by Count Rumford, though we are assured that Mr. Evans had no knowledge of that gentleman's experiments.

Mr. Evans has taken out a patent; and seems to think, correctly, we believe, that his machine will be applicable to a number of other purposes, such as the drying, distillation, and decomposition of different vegetable substances. Whether this expectation is well founded or not, we cannot at present decide; but the chemical principles of roasting coffee on which he proceeds are so well established, and his adaptation of mechanical means to carry them into effect so ingenious, that we are persuaded his method will be generally adopted by the manufacturer, and that he will be encouraged by the approbation of all coffee drinkers.

DIURNAL MOTIONS OF THE BAROMETER.

SIR,—The Monthly Magazine, for the 1st of January, 1806, came into my hands, by accident, a few days subsequent to the appearance of my communication in your Magazine, wherein I perceived accounts of the Diurnal Variations of the Barometer, extracted from papers submitted to the Royal Society. I was somewhat surprised at this, as I had failed in obtaining any information on the subject, though, as I stated on a former occasion, I had, in anticipation, made several inquiries after it.

These papers are as confirmatory of the hypothesis I have advanced, as the nature of the instruments, and the times and places of observation were capable of rendering them.—There are a variety of circumstances, general as well as local, to be taken into account in making observations on this phenomenon, even with the iustruments best adapted for the purpose, which cannot fail to have considerable influence in rendering such small effects almost imperceptible, and, with a common barometer, totally out of the reach of the most acute observer.

Enclosed, you have the extracts alluded to, which you will oblige me by giving a place in your pages.

I am, Sir, &c.

WM. GILMAN.

Royal Society, London, Jan. 1, 1806.

Henry Cavendish, Esq., a member of this learned body, has submitted to the Society an "Abstract of Observations on a Diurnal Variation of the Barometer between the Tropics,"—By J. Horsburgh, Esq.

This gentleman, in his voyage to the East Indies, employed two marine barometers and thermometers, which were exposed to a free current of air in a cabin, where the basins of the barometers were thirteen feet above the level of the sea.—The hours for observation were at noon, four and twelve in the afternoon, and at four and seven in the morning; because Mercury in the barometer had at these times been proved to be regularly stationary between the tropics. It was found that, in settled weather, in the Indian seas, from eight A.M. to noon, the Mercury was not only stationary, but, at the point of the greatest elevation, afternoon, it began to fall, and continued falling till four o'clock, when it was at the lowest point of depression. From four to five the Mercury rose, and continued rising till about nine P.M., at which time it had gained its highest elevation, and continued stationary till midnight; it then fell till four o'clock, when it was as low as it had been in the preceding afternoon; from this time it rose till seven or eight, and continued stationary till noon.

Thus was the Mercury subject to a re-

gular elevation and depression twice in twenty-four hours, in settled weather, and the lowest station was about four o'clock in the morning and evening; from these times till eight in the morning and nine in the evening, it had a regular tendency to rise, when it was stationary till noon and midnight.

In unsettled and blowing weather, especially at Bombay, during the rains, the regular ebbings and flowings of the Mercury could not be perceived. The atmosphere seems to produce a different effect on the barometer at sea from what it does on shore, as the following abstract will show:

From leaving the Land's-End the Mercurywas fluctuating and irregular till they came to lat. 26 N. long. 20 W.; it then uniformly performed two elevations and two depressions every twenty-four hours. From lat. 26 N. to 10 N. the difference of high and low stations of Mercury in the barometers was not so great as it was from lat. 10 N. to 25 S. Within these last mentioned limits, the difference of high and low stations of the Mercury in the barometers was from 500 to 900 parts of an inch, both in the daily and nightly motions.

In lat. 28 S. it was again fluctuating, and continued so till 27 S., when it became subject to the equatropical motions, and continued so till the ship reached Bombay, August 6th, 1802. On shore, for the first six days, the Mercury had a small tendency towards performing these motions: but from the 12th to the 22d of August they could not be perceived.

On leaving the harbour, they were again very perceptible, and continued so, with great uniformiity, till the arrival of the ship in Canton river, October 4th. It then became nearly stationary, and on shore at Canton, the barometer had little tendency to the equatropical motions through the months of October and November. Observations similar to the foregoing were made from this time till the arrival of the ship in Margate Roads, which went to the confirmation and establishment of the same facts.

Mr. Professor Playfair has presented to this Society "A comparison of some Observations on the Diurnal Variations of the Barometer, made by M. Lamanon, in Perousee's Voyage round the World, with those made at Calcutta, by Dr. Balfour."

The agreement between these is remarkable. Dr. Balfour found, during the whole lunation, in which he observed the barometer from half hour to half hour, that the Mercury constantly fell from ten at night to six in the morning, and from six to ten in the morning it rose; from ten in the morning to six, it fell again, and, lastly, rose from six to ten at night. The greatest height is, therefore, at ten at night and ten in the morning, and the least at six at night and six in the morning.

The only difference between this and the result of M. Lamanon's observations is, that according to the latter, the minimum is stated to have happened about four instead of six.

According to Dr. Balfour, the variations of the barometer are connected with the reciprocations of the sea and land winds during the day and night. But the probability of this supposition is destroyed by the observations of the French navigators. These observations were made too far out at sea, to leave room for supposing that the land winds had any influence in the phenomena to which they refer.

It is, at the same time, doubtful whether these phenomena can be ascribed to the atmospherical tides produced by the sun and moon, as the ebbing and flowing of the Mercury in the barometer appears to have no dependence on the position of these luminaries relatively to one another, but happens, it should seem, constantly at the same hour, in all aspects of the moon, and all seasons of the year.

PERFORATING GLASS.

GENTLEMEN:—

At the last sitting of the Managing Committee of the Mechanics' Institution, one of its members (Mr. Le Gros) exhibited a pane of common window glass perforated completely through, and nearly of a circular form, without the glass being, as it is technically called, starred; he assured us it was done with a center punch, and hammer on an anvil. As a process so simple as this is calculated to produce a most important improvement in the manufacture of glass furniture and ornaments, I think you cannot give it too early an insertion.

Your most obedient,
T. B.

A PUZZLE.

Gentlemen:—Perceiving that some of your Correspondents amuse themselves and your readers with anylitical puzzles, I send you the following, in hopes of seeing its truth admitted, or its falsehood proved. X

Assertion—*One is equal to two.*
Demonstration required.

BREAD AND POTATOES.

SIR,—I shall feel greatly obliged to any of your Correspondents who will furnish me through your Magazine, with a description of the mill used for grinding potatoes for the baker, or who will inform me where I can procure it.

I am fully convinced, by trial, that potatoes tend to make bread lighter than wheat flour alone can do, and chemical analysis shows bread so made to be wholesome and nutritious. It will, perhaps, excite surprise, that I should recommend a practice for which bakers are generally condemned and held up as men who pick our pockets and feed us with poison; but if they confined the mysterious part of their science to the introduction of potatoes, we need be under no apprehension about the latter, though there might be some difficulty in acquitting them of the former, because bread is made at less expense with an admixture of potatoes than with flour alone; but who would deal with the baker who should advertise cheap bread, composed of flour and potatoes?—Prejudice, invincible prejudice would be his ruin.

The people must have pure wheaten bread, and so white to boot, that it is impossible it can be pure. The baker is thus compelled, *nolens volens*, to have recourse to deception, and to plunge his thumbs into as strange a composition of heterogenous ingredients as that into which the pilot's thumb was introduced by the weird sisters of Shakspeare, and with a somewhat similar effect—a train of ghostly loaves are *raised*, and the customers are satisfied.

I wish to take this opportunity of correcting a mis-statement in "Cobbett's Cottage Economy," respecting the comparative merits of wheat and potatoes, to the latter of which he appears to entertain as *rooted* an antipathy as if all *pommes de terre* were *grands homme de terre*. Let him rail against the *potentates*, if he will, but let him not send forth such a libel against *potatoes*, as to assert, as "an established fact," that they contain only *one tenth* of their weight in nutritive matter; whereas, it has been ascertained, by Sir H. Davy, Gay Lussac, and other chemists, that *one quarter* of their weight is nutritive.

The quantity of nutritive matter, thus calculated, in an acre of potatoes, so far from being, as Cobbett attempts to prove, much less than that in an acre of wheat, is more than double. I will meet him on his own *ground*, an acre of which, he states, will produce thirty-two bushels of wheat, or three hundred bushels of potatoes; now, thirty-two bushels of wheat weigh 1920 pounds and three hundred bushels of potatoes weigh 16,800 lbs, one quarter of which, viz. 4200 pounds, is nutritive, making a balance of 2280 pounds in favour of potatoes.

The parings are not deducted, but neither is the bran, the weight of which is ten pounds in every sixty, or in every bushel, which will, at least, equal the loss in paring the potatoes.

I am, Sir,
Your humble servant,
PHILO-MURPHY.

GENIUS OF INVENTION.

"If you would have a man display all the native resources of his mind," says an eloquent writer in the Edinburgh Review—"if you would bring all his faculties and powers into full activity, you must deprive him of all adventitious assistance, and render him exclusively the architect of his own fortune. It is not to those who have been born with a competency, but to those who have been bred in the hardy school of poverty, and who have raised themselves to an eminence, that mankind are indebted for almost all those improvements and inventions which have so greatly extended the empire of mind and matter, and made such vast additions to the sum of human happiness. Notwithstanding its being the great avenue to power and emolument, it has been frequently remarked, that there is scarcely an instance of an individual possessed of 500l. per an-

num of patrimony making any figure at the English bar! The same observation might be extended to most other professions. Necessity is the grand goader, and therefore *poverty* is a part of the universal system."

Why, then, should a man be accused of being radical or jacobinical, *merely* for saying, "I know no other claims to my respect than those founded on useful talent, coupled with industrious and honest application?" What are hereditary honours and riches, in comparison with the meritorious application of talent?—Have not both the first been transferred to the owner by *another*, in whom alone *all* the claim centres and remains of *all* the honour, or perhaps, of all the *disgrace*, of having acquired them? How widely different is not the case with the man of talent? TO HIM belongs *all* the honour *exclusively*: HE is indebted to no one but *himself*. What an enviable badge! What are hereditary honours compared to it? The only transfer that, in his case, takes place, consists in *his* tranferring, not to his heirs only, as in the above is the case, but to the community, nay, to posterity, those immense, those lasting and incalculable benefits, *which talent* ALONE *can confer*.

The useful inventor takes a mite out of the millions he confers; THIS *I call princely liberality*; whilst the nobles and the great, who claim on hereditary grounds, take the millions, too often without even returning the mites to those who have contributed the millions. By purse-proud fools, and such other undeserving beings—by such real PAUPERS in talent and industry, the useful man of talent is often called a schemer—a needy adventurer—a beggar—or a member of "the swinish multitude!" And why? Merely because he is not living on the *bounty* of his ancestors, or as a sinecurist, on the *charity* of the community. Any idiot can consume the earnings of others which are *given* to him: and if poverty is a disgrace, it can only be that poverty which indolence cherishes, or extravagance creates; including the poverty of mind so common with the self-sufficient man of purse, who, although possessed of the opportunity, seconded by splendid means for cultivating his mind, and applying talent so engendered, in the innate poverty of his narrow mind, fails to do so; whilst the man deficient of property, energetically, and under every galling disadvantage, breaks down the greatest of all obstacles, not only to live truly independent, but even *to give fortunes to others*. He wants no one to confirm his nobility, much less to confer it: He ennobles himself, for his heraldic vouchers of true nobility are to be read in every invention or improvement by which the community is benefited—monuments more convincing and more lasting than those *explored* by the Herald Office; and as to his being a *pauper*, *is he not rather a* TREASURY, *upon which all the world draws, without its ever stopping payment?* Hereditary rank and wealth sink into insignificance, compared with such distinctions.

I am, Sir,
Your obedient servant,
JUNIUS ANAXARCHUS.

PROPOSED METHOD FOR CONSTRUCTING A LARGE LENS.

SIR,—The great difficulty which attends the procurement of glass castings for lens of considerable size, involves too great an expense to warrant their use for common experiments. When solid, they are exceedingly liable to fracture, from sudden changes in temperature, owing to their expansible and slow heat-conducting properties; and when made of plate glass, the danger is scarcely diminished, because of a similar liability, and the intent care necessary to be observed while they are in use.

These circumstances place them beyond our prudential reach; but the curious who reside in cold climates have it in their power to substitute ice lens for those of glass.—They may be either frozen in moulds or turned from blocks of ice, and their size may be greatly increased, insomuch as to put the utmost skill of the glass manufacturer at defiance.

At first view, it may appear paradoxical, that with a lens composed of

this material, we should be able to fuse or dissipate the most refractory substances in almost an instant of time; but nevertheless, such, no doubt, will be found the case, should an experiment of this nature be made on an extensive scale.

PHAETON.

Greenwich, New-York, April 24th, 1825.

OUTLINE OF A PROJECT TO SUPPLY THE CITY OF NEW-YORK WITH WATER.

SIR,—The sources of supply which I would recommend for present use, are,—First, the Bronx and Saw-mill rivers, and,—Secondly, the Croton river.

The quality of the water of the two former has been examined, and found excellent; and no doubt, from the character of the country in which it originates, the latter is equally good. To save expense, the mill privileges on these streams should be purchased only as far up from their entrance into the North and East rivers as will ensure the delivery of all the water they contain in dry seasons, at some appropriate point on the East river, just above high water mark, for the purpose of being elevated for distribution through the city.

The water ought to be conveyed in an aqueduct composed of hard burned bricks, and a mortar containing very little if any lime; for, if much lime be used, the water will dissolve it, and become hard and unfit for many domestic purposes.

Where the level is interrupted by valleys, &c, iron pipes should be substituted for masonry work, unless it would be less expensive to fill up such valleys, or extend the aqueduct across them on arches.

The aqueduct for the Saw-mill river should be led along the margin of the North river, and the straight which separates Manhattan Island from the main, till it can be united with the aqueduct from the Bronx, at or near Harlem; and in constructing these aqueducts, regard should be had to dimensions: so that an additional supply of water, equal to the wants of the city, may be admitted to them from the Croton river, at some future day.

From Harlem, the aqueduct should be extended along the margin of Harlem creek and the East river to within a convenient distance of the city, where it may be raised to a distributing reservoir, either by tide water wheels (see the water wheel described in No. 8, pp. 114, 115, of this Magazine) or a steam engine.

On the route of the aqueduct one or more reserviors should be constructed for the water to pass through, and deposite any sediment it may previously hold in suspension.

Instead of masonry work, the water may be led in an open canal; but the waste that would necessarily result from absorption and evaporation, independent of leakage, through so long a line, would operate much against such a measure besides, as it would require to be perpetually fenced and as the land through which it would pass would have to be purchased out and out, the expense, it is believed, would amount, in either case, to very nearly the same.

Under these views of the subject, the aqueduct of masonry is to be preferred; it would not cost over ten or twelve thousand dollars per mile, provided the excavation be not much interrupted by rocks and broken land; while iron pipes of twenty four or twenty six inches diameter would cost from fifty to sixty thousand dollars for the same distance.

FULTON.

New-York, April 26th, 1825.

COLOURING LEATHER.

To your correspondent Edward, I would reply, that a beautiful yellow may be obtained by using the tincture of tumeric, formed by infusing an ounce or more of the root, powdered, in a pint of spirit of wine. This may be diluted or strengthened, so as to produce a tint from the lightest straw to the most brilliant yellow.

Indian lake, infused for some days in spirit of wine, and then pouring off the tincture from the dregs, will produce a very fine crimson stain for parchment, and perhaps leather too.

J. R.

BORING FOR WATER AROUND THE METROPOLIS.

Previous to the Tottenham fountains being produced by boring, I was acquainted with the fact of water rising to within a few feet of the top (varying only according to the irregularity of the ground) of wells sunk through an impervious clay of about three hundred feet in depth, in the neighbourhood of Clapham common, at a height considerably above the Thames; and in consequence of the effect being the same on the north side of the river as there, which is proved by the Tottenham fountains, I have, with a view of showing that a more valuable advantage may be taken of this circumstance, been at some little trouble to investigate how far it can be made available, and the result I will briefly state.

London and its environs, to the extent of some miles, are situated on an immense bed of clay, of from two to three hundred feet in depth, forming a valley generally of considerable extent, but of no great breadth, not very distinctly defined and consequently not very perceptible. Through this valley flows the Thames, without having any connexion with the main springs. The rain water accumulated in the porous soils in the immediate vicinity of this body of clay, cannot fall to a level with the Thames until it has risen to a sufficient height to run over the surface of the clay, oozing through the gravel by which that is covered, either into the Thames, or the nearest tributary stream. Hence the cause of the water rising above the Thames, as at the fountains at Tottenham, &c.—The height from which the water there issues, is about twenty feet above high water mark, and by adding thereto the height due to the velocity of the issuing fluid it agrees, as nearly as possible, with the height at Clapham.

It may be hence deduced, that the whole of the houses on the southward side of the river may be supplied with water by boring. The water can be laid on to as many houses as the supply from each boring is equal to, at at least one half the charge per annum of the present water work companies, and the public will besides be provided with the most pure and soft water that can be obtained. The wells would be seldom, if ever, out of repair, and require no expense when completed, not even a turncock. Were this mode of supplying water undertaken on any considerable scale, it would afford to capitalists one of the best means of investing property ever undertaken, and pay at least 25 per cent.

Having such a considerable fall in the Borough, these fountains may be employed with advantage and success as a moving power to machinery, where no great force is required. In other situations they might be introduced both for purposes of ornament and utility. In St. James's Park, for example, a fountain might be opened, which, after playing, would afford a continued supply to that stagnant pool the canal, by which it would be considerably improved.

I am, Mr. Editor,
Your humble servant,
G.

Fieldgate-street, October 4, 1823.

P. S.—Your Correspondent G. S. can scarcely be serious in his inquiry for information respecting the effect of boring for water in porous strata, as I should consider the subject too well understood to admit of two opinions. It is certainly true, however, that most of the publications (at least of those I have read) respecting the effect of boring in the neighbourhood of London, would lead one to conclude that its application and effect would be universal, as no explication whatever, of the cause of this effect is entered into.

In all porous soils, where the surface of earth is below the level of the spring, the water will always find means of escaping without the aid of human intervention; hence the cause of our rivers, which carry off all superfluous waters; but if we open the earth by boring, or otherwise, above the level of the spring, the only means of coming at this useful element is, by lifting it to the surface, unless your Correspondent's townsmen are possessed of the knowledge of some

secret reservoir acted upon by steam, produced from some caldrons in Ætna, to do the labour for them, to which we must consider their sapient endeavours are directed.

Yours, respectfully,

G.

From another Correspondent, on the same Subject.

Mitcham, Surrey.

Sir.—In looking over your Magazine I observed a question asked under the head of "Boring for Water," viz Whether there is any other spring or reservior of water in the bowels of the earth, exclusive of what may be termed temporal or perennial? As it respects springs of water, I am not aware what may be termed lemporal or perennial knowing but few that give a constant yearly supply. As a real deprivation of water in wells of that description too often occurs, I beg leave to observe, that in my practice of boring for water, I have frequently found another, or mainspring of water, that did not seem to have the least connexion with those termed land springs, or springs arising from frequent rains. Such springs are usually found from ten to fifty feet below the surface. Although to the well borers these springs generally prove annoying (for they can seldom be brought to flow over,) yet in many instances I have bored past them to a depth of from two to four hundred feet. In evidence of this, I can show to any person wells bored twelve months ago, that cast up from ten to fifty gallons of excellent and remarkably pure water, invariably soft, which, without the use of engine or pump, will rise from twenty to thirty feet above the surface, up a tube put on to the guide-pipe, or top of the well. To instance a few wells thus bored—There is one on the coach road side at Tooting, five miles from Westminster bridge, bored at the expense of the parish, and another at the same place, on the premises of Mr. Relason, nurseryman, both abundant springs; there are three wells on the estate of the Rev. R. Cranmer Mitcham, Surrey, and one on the premises of Messrs. Holden, coach proprietors, Mitcham. At Merton, Surrey, eight miles from Westminster bridge, there are four wells bored, each casting up at least fifty gallons of water per minute; and on my own land there is one well, which casts up nine gallons per minute.

To give other references would be superfluous. As to the cause that impels a main spring to rise from a depth of from two to four hundred feet below, and to such a height above the surface, I believe there can be no doubt that it is owing to a connexion with springs in other lands of higer elevation than our own. Should you deem these few remarks useful or satisfactory to the inquirer, I shall be gratified by your inserting them in your useful Magazine.

I am, Sir, your obliged
Humble servant,
T. EDGE,
Borer for Coals and water.

There can be no doubt whatever, that the same laws must govern the gravitation of water below as above the earth, and that of course the jet of any stream can never, unless through artificial causes, ascend higher than its source. It is but in a few cases possible to point with certainty to the feeders of particular springs: but there is one thing still more difficult to authenticate, namely, the fact of flowing water having been ever obtained by boring land higher than all the land around it.—ED.

PERPETUAL MOTION.

Pimlico.

GENTLEMEN:

In your valuable work I observe a paragraph respecting the various attempts that have been made to obtain perpetual motion, but which, in my humble opinion, can never be accomplished.

I have witnessed, however, a nearer approach to a method of obtaining perpetual motion than is set forth by your Correspondent, which, if I comprehend it rightly, only shows one pump for raising the water over the wheel, but which is not sufficient to carry the wheel round. In the case I witnessed there were two pumps, which moved successively after each

other, by which means the wheel, if it were possible to overcome the friction, would be kept in constant motion; whereas, after the contents of a single pump are discharged on the wheel, it would immediately stop.

But however an engine of this description may be made, it is utterly impossible to overcome the friction of the bearings, couplings, levers, &c.

A constant reader,

T. B.

THE CHAIN WHEEL.

This is an invention of the Chinese, and used by that ingenious and industrious people in the mechanism they make use of in irrigating their fertile fields. drawings and descriptions of which are to be met with in almost every book of modern geography, and have evidently given the idea of the tread mill (that base engine of cruelty now at work in the neighbourhood of London) to some mean-soul'd mechanic.

Wheels of this plan were first introduced into Europe by wandering French Jesuits, and were used in raising water out of the river Seine, for the benefit of the inhabitan s of Paris Afterwards they were brought to Britain, and used under various modifications, as in mines with slanting sh fts, deepening of harbours, and doc works

About ten or fifteen years ago, a humble millwright in Scotland, of the name of Gladstone, who had never heard of the chain-wheel, or of any of its modifications, gave to the arts a variety of it, of great value; this was that well known article in thrashing machines called the "travelling shaker," which not only conveys the straw away to a house, from the place it is thrashed, but also shakes out any grain that may be among it, thereby saving much labour to the husbandman.

When he found this answer its end so well, he applied the chain wheel to another purpose, the "bucket-wheel," thus furnishing an outer wheel to mills, which required less water to drive or turn it, than the one which it displaced, the common circle wheel; for these useful inventions he received a medal and a premium from the Agricultural Society of Scotland.

Still he thought that more might be done with this wheel; he accordingly set about applying it to the better propelling of steam boats; and having fixed his chains with paddles on them, to the sides of a large rowboat, he tried how things might succeed on a lake in his neighbourhood; the paddle wheels were turned by the hands of men, and the engineer was astonished at the velocity with which the boat ploughed the fluid: having noted this, as to the time it took in sailing a certain distance he took off the paddle wheels, and affixed on the common sort; but the boat with these on, though the same power was given them, was three times longer in sailing the distance. What a difference was here! The same experiment was tried in one of the Liverpool docks, and the result was the same.

By the aid of a friend a patent was taken out, but no proprietor of steam boats could be found willing enough to exchange the old plan for the new. So the thing rests: an invention that would be of the greatest benefit is here laid aside; an invention equally secure with the other one which makes far less noise when going, can be made with less expense, and answers the purpose three times better, is considered nonsense!

MACTAGGART.

DARKENING MAHOGANY.

December 30, 1823.

Your Correspondent T. L. has given a method of darkening mahogany with lime water, which is the quickest method that can be found, and the best; but he has forgotten to mention how a person is to proceed after the mahogany has been washed with lime water. The method is simply this—after the wood has dried, take a hard brush, and rub it quite clean; then polish it with turpentine and bees'-wax, or linseed oil.

T. T. SIMPSON.

MUSICAL FISH.

(From the London Chemist.)

The following account of a musical phenomenon, supposed to be produced by fish, may not be unacceptable to our readers. It is taken from lieutenant White's History of a Voyage to the China Sea, and occurred to him at a spacious estuary on the Douai river, in Cochin China:—"Our ears were saluted by a variety of sounds resembling the deep bass of an organ, accompanied by the hollow guttural chant of the bull frog, the heavy chime of a bell, and the tones which imagination would give to an enormous Jew's-harp. This combination produced a thrilling sensation on the nerves, and, as we fancied, a tremulous motion in the vessel The excitement of great curiosity was visible on every face on board, and many were the sage speculations of the sailors on this occasion. Anxious to discover the cause of this gratuitous concert, I went below, where I found the noise, which I soon ascertained proceeded from the bottom of the vessel, increased to a full and uninterrupted chorus. The perceptions which occurred to me on this occasion were similar to those produced by the torpedo or electric eel, which I had before felt; but whether these feelings were caused by the concussions of sound or by actual vibrations in the body of the vessel I could neither then nor since determine. In a few moments the sounds, which had commenced near the stern of the vessel, became general throughout the whole length of the bottom. Our linguist informed us that our admiration was caused by a fish of a flat, oval form, like a flounder, which, by a certain conformation of the mouth, possesses the power of adhesion to other objects in a wonderful degree, and that they were peculiar to the Seven Mouths (the part of the river where we then were;) but whether the noises we then heard were produced by any particular construction of the sonorific organs, or by spasmodic vibrations of the body, he was ignorant. Very shortly after leaving the basin, and entering the branch through which our course lay, a sensible diminution was perceived in the number of our fellow-travellers, and before we had proceeded a mile they were no more heard. On the ship's return down the river, the same submarine serenade again saluted the ears of the crew at the same spot."

CIRCULATION OF THE BLOOD.

(From the London Chemist.)

The following eloquent description of the circulation of the blood, by Dr. Paley, may not be unacceptable to the youthful readers of The Chemist, particularly as its pages have lately contained a dry, but we hope correct account of the process of respiration and animal heat.

"There is provided in the central part of the body a hollow muscle, (the heart) invested with spiral tubes, running in both directions By the contraction of these fibres, the sides of the muscular cavities are necessarily squeezed together, so as to force out from them any fluid which they may at that time contain: by the relaxation of the same fibres, the cavities are in their turn dilated; and, of course, prepared to admit every fluid which may be poured into them. Into these cavities are inserted the great trunks, both of the arteries which carry out the blood, and of the veins which bring it back This is a general account of the apparatus; and the simplest idea of its action is that by each contraction a portion of blood is forced as by a syringe into the arteries; and at each dilation an equal portion is received from the veins This produces, at each pulse, a motion and change in the mass of blood to the amount of what the cavity contains, which in a full-grown human heart is about an ounce, or two table-spoons full Each ventricle will at least contain one ounce of blood. The heart contracts four thousand times in one hour; from which it follows, that there pass through the heart every hour four thousand ounces, or 350lbs. of blood, troy weight. Now the whole mass of blood is about 25lbs. so that a quantity of blood equal to the whole blood within the body passes through the heart fourteen times in one hour; which is about once every four minutes. Only consider what this is in very large

animals. The *aorta* of a whale is larger in the bore than a main pipe of the water works at London Bridge; and the water roaring in its passage through that pipe is inferior in impetus and velocity to the blood gushing from the whale's heart." According to Dr. Hunter, ten or fifteen gallons of blood are thrown out of the heart of a whale at a stroke, with an immense velocity, through a tube of a foot diameter. The whole idea fills the mind with wonder. See Dr. Hunter's account of the dissection of a whale, in the Philosophical Transactions.

"It was necessary that the blood should be successively brought in contact or proximity with the air; therefore, as soon as the blood is received by the heart from the veins of the body, and before that it is sent out again into its arteries, it is carried by the force of the contraction of the heart, and by means of a supplementary artery, to the lungs; from which, after it has undergone the proper change, it is brought back by a large vein once more to the heart, in order, when thus prepared, to be from thence distributed anew into the system.

"An anatomist, who understood the structure of the heart, might say beforehand, that it would play, but he would expect, I think, from the complexity of its mechanism, and the delicacy of many of its parts, that it would always be liable to derangement; or that it would soon work itself out. Yet shall this wonderful machine go, night and day for eighty years together, at the rate of a hundred thousand strokes every twenty-four hours, having at every stroke a great resistance to overcome; and shall continue this action for this length of time without disorder and without weariness."

Paley's Natural Theology.

WATCHES.

December 24 1823.

GENTLEMEN:

Agreeably to the request of your Correspondent "Ignoramus," I send a short description of the different kinds of watches or timepieces for the pocket. The first and least liable to be affected by the different changes of temperature is a pocket chronometer. It is so constructed as to keep the same rate of time in the extremes of heat and cold; this is obtained partly by its having a balance of two metals united, so as to have the contrary effect, in respect to expansion and contraction, which all other bodies of one metal only have, and partly by great nicety in the shape of the pendulum or balance spring. In fact, the whole of the chronometer is made on a principle to ensure better performance than any other sort of timepiece. The next on the list is a duplex watch, with a compound balance; for these balances may be applied to timepiecss having different escapements from the chronometer. The next I take to be the watch with the detached lever escapement, and after that the horizontal watch; then come the watches on the common vertical principle, which are very good, if made well. There are also two or three other escapements, but they are not of general use, and I do not consider them as possessing any advantages over those already mentioned.

Yours respectfully,

H. T.

SKY-LIGHTS.

SIR,—I beg leave to add an observation or two to those of your Correspondent E. R. on Sky-Lights.

Unless a good coat of oil-colour is previously laid on, and has become perfectly dry, any sky light you may construct will prove a leaky one; because the wood will draw the oil from the putty, and cause it to shrink. I differ in opinion as to having a deep rabbet; I think three-eighths of an inch sufficient. The deeper the rabbet is, the more putty it will require. Now it is well known that putty has a tendency to become solid, and will shrink from the sides (of wood and glass) and form openings to admit water. A small fillet of putty will of course not shrink so much as one four times the size, simply because there is less quantity of substance to shrink. Let your glass be cut to a full size, and well bedded.

Yours, &c. R. J.